Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1.(original) A method for forming an MTJ memory cell having a substantially circular horizontal cross-section, wherein a ferromagnetic free layer in said cell has uniaxial magnetic anisotropy provided by exchange coupling with an antiferromagnetic layer comprising:

providing a substrate;

forming on said substrate a layered magnetic tunneling junction (MTJ) structure, said formation further comprising:

forming on said substrate a seed layer;

forming on said seed layer a bottom antiferromagnetic layer;

forming on said bottom antiferromagnetic layer a synthetic antiferromagnetic (SyAF) pinned layer;

forming on said pinned layer a tunneling barrier layer;

forming on said tunneling barrier layer a ferromagnetic free layer;

forming on said ferromagnetic free layer a top antiferromagnetic layer;

forming on said top antiferromagnetic layer a capping layer;

annealing said layered MTJ structure in an external magnetic field, thereby pinning said SyAF layer and exchange coupling said top antiferromagnetic layer to said ferromagnetic free layer to produce, thereby, a uniaxial magnetic anisotropy in said free layer;

patterning said layered MTJ structure to create a horizontal cross-sectional shape that is substantially circular.

2.(original) The method of claim 1 wherein said seed layer is a layer of NiFe, NiCr, NiFeCr, Cu, Ti, Ta, Ru, Rh, TiN, TiW, W or TaW formed to a thickness between approximately 5 and 500 angstroms.

3.(original) The method of claim 1 wherein said bottom antiferromagnetic layer is a layer of the antiferromagnetic material IrMn, RhMn, RuMn, OsMn, FeMn, FeMnCr, FeMnRh, CrPtMn, TbCo, NiMn, PtMn or PtPdMn and it is formed to a thickness between approximately 40 and 400 angstroms.

4.(original) The method of claim 1 wherein said SyAF pinned layer is formed by a method further comprising:

forming a first layer of ferromagnetic material on said bottom antiferromagnetic layer;

forming a coupling layer on said first ferromagnetic layer;

forming a second layer of ferromagnetic material on said coupling layer.

5.(original) The method of claim 4 wherein said first and second ferromagnetic layers are layers of Co, Ni, Fe or their alloys or CoFeB, formed to thicknesses between approximately 5 and 100 angstroms

6.(original) The method of claim 4 wherein said coupling layer is a layer of Ru, formed to a thickness between approximately 7 and 8 angstroms or a layer of Rh formed to a thickness between approximately 5 and 6 angstroms.

7.(original) The method of claim 1 wherein said tunneling barrier layer is a layer of Al_2O_3, ZrO_2, AlN, HfO_2 or multilayers thereof and said tunneling barrier layer is formed to a thickness between approximately 3 and 30 angstroms.

8.(original) The method of claim 1 wherein said ferromagnetic free layer is a layer of Co, Ni, Fe or their alloys, CoFeB, CoZrB, CoTaB or CoHfB formed to a thickness between approximately 3 and 300 angstroms.

9.(original) The method of claim 1 wherein said top antiferromagnetic layer is a layer of IrMn, RhMn, RuMn, OsMn, FeMn, FeMnCr, FeMnRh, CrPtMn, TbCo, NiMn, PtMn or PtPdMn and it is formed to a thickness to optimize the uniaxial anisotropy of the ferromagnetic free layer.

10.(original) The method of claim 9 wherein said top antiferromagnetic layer is a layer of IrMn, RhMn, RuMn, OsMn, FeMn, FeMnCr, FeMnRh, CrPtMn, TbCo, NiMn, PtMn or PtPdMn formed to a thickness between approximately 2 and 20 angstroms.

11.(original) The method of claim 1 wherein said annealing comprises raising the MTJ structure to a temperature between approximately 100^0C and 400^0C for a time between approximately 0.5 and 20 hours in an external magnetic field between approximately 100 and 20,000 Oe.

12.(original) The method of claim 1 wherein said patterning produces a circular horizontal cross-section with a diameter of approximately 1.0 microns or less.

13.(original) The method of claim 1 wherein said substrate is a planarized layer of insulation containing therein a conducting word line and wherein said MTJ structure is formed substantially over said word line.

14.(original) The method of claim 13 wherein a bit line is formed over said MTJ structure in a direction orthogonal to said word line.

15.(original) An MTJ memory cell having a substantially circular horizontal cross-section, wherein a ferromagnetic free layer in said cell has uniaxial magnetic anisotropy provided by exchange coupling with an antiferromagnetic layer comprising:

a substrate;

a layered magnetic tunneling junction (MTJ) structure, formed on said substrate, said MTJ structure comprising:

a seed layer;

a bottom antiferromagnetic layer formed on said seed layer;

a synthetic antiferromagnetic (SyAF) pinned layer formed on said bottom antiferromagnetic layer;

a tunneling barrier layer formed on said pinned layer;

a ferromagnetic free layer formed on said pinned layer;

a top antiferromagnetic layer formed on said ferromagnetic free layer;

a capping layer formed on said top antiferromagnetic layer; and

wherein said top antiferromagnetic layer is exchange coupled to said ferromagnetic free layer to produce, thereby, a uniaxial magnetic anisotropy in said free layer; and

wherein said layered MTJ structure has been patterned to create a horizontal cross-sectional shape that is substantially circular.

16.(original) An array of MTJ memory cells having substantially circular horizontal cross-sections, wherein a ferromagnetic free layer in each such cell has uniaxial magnetic anisotropy provided by exchange coupling with an antiferromagnetic layer and wherein each such cell is located at an orthogonal intersection of a word line and a bit line and is positioned substantially between said word line and bit line.